

*** NOTICES ***

JPO and INPIT are not responsible for any damages caused by the use of this translation.

1. This document has been translated by computer. So the translation may not reflect the original precisely.
2. **** shows the word which can not be translated.
3. In the drawings, any words are not translated.

CLAIMS

[Claim(s)]

[Claim 1] An electrostatic chuck device formed in a mounting base inside a processing chamber in order to carry out adsorption maintenance of the processed material characterized by comprising the following according to electrostatic force.

A conductive film in which voltage is impressed when adsorbing said processed material.
An insulating film of a couple which puts this conductive film from both sides.

[Claim 2] The 1st circumferentia to which said protect ring member counters an edge part of the surface of said chuck body, Have the 2nd circumferentia that counters a base part of said mounting base, and the 1st O ring and 2nd O ring are provided in said 1st circumferentia and said 2nd circumferentia, respectively, The electrostatic chuck device according to claim 1 isolating airtightly said exposed part of said adhesives or a low melting point metal from a building envelope of said processing chamber according to inner skin of said 1st and 2nd O rings and said protect ring member.

[Claim 3] The electrostatic chuck device according to claim 1 or 2, wherein said mounting bolt is a shoulder bolt which can prevent breakage of said protect ring member by excessive bolting.

[Claim 4] The electrostatic chuck device according to any one of claims 1 to 3, wherein said mounting base is fixed to an inside of said processing chamber by fixing said protect ring member to an inside of said processing chamber with said mounting bolt.

[Claim 5] The electrostatic chuck device according to any one of claims 1 to 4, wherein said chuck body is provided with a protective film which comprises fluororesin stuck on the surface.

[Claim 6] A mounting base for laying a processed material which is provided with the electrostatic chuck device according to any one of claims 1 to 5 and with which said chuck body is stuck on the surface by said adhesives or low melting point metal.

[Translation done.]

*** NOTICES ***

JPO and INPIT are not responsible for any damages caused by the use of this translation.

1. This document has been translated by computer. So the translation may not reflect the original precisely.
2. **** shows the word which can not be translated.
3. In the drawings, any words are not translated.

DETAILED DESCRIPTION

[Detailed Description of the Invention]**[0001]**

[Field of the Invention] Especially this invention relates to the electrostatic chuck device and mounting base for carrying out adsorption maintenance of the processed material in the inside of the processing chamber of a vacuum processor with respect to an electrostatic chuck device and a mounting base.

[0002]

[Description of the Prior Art] In various kinds of processes, such as a semiconductor manufacturing process, a liquid crystal display panel manufacturing process, or an optical disk manufacturing process, in order a silicon wafer, a glass substrate, etc. are circular or to perform the surface treatment of a square-shaped processed material, the vacuum processor is used. That is, a vacuum processor is a device for processing sputtering, etching, baking powder, or ashing, and forming a thin film on the surface of a processed material, or performing micro processing to the thin film formed in the processed material surface to the processed material carried in to the inside of the vacuum housing.

[0003] One of the vacuum processors has a downflow type chemical-dry-etching device (CDE device), and this CDE device, After activating process gas in the plasma generating chamber separated from the processing chamber, it is a device which introduces this process gas into the inside of a processing chamber, supplies on the surface of a processed material, and carries out the etching process of the thin film on the surface of a processed material by the neutral radicals (neutral active species) in process gas. Here, oxygen gas, CF₄ gas, etc. are used for process gas.

[0004] There is a reactive ion etching system (RIE system) as other examples of a vacuum processor, and this RIE system, It is a device which performs the etching process of a processed material using the plasma which plasma-ized the process gas supplied to the inside of a processing chamber using high frequency voltage, and was formed in the inside of a processing chamber.

[0005] There is a microwave-plasma-etching device as other examples of a vacuum processor, and this device is a device which impresses microwave to the process gas supplied to the inside of a processing chamber, generates microwave excitation plasma, and etches using this plasma.

[0006] And the mounting base for laying a processed material is formed in the inside of the vacuum housing of the vacuum processor mentioned above, and the temperature of this mounting base is adjusted by a temperature control mechanism. Therefore, the temperature is controlled by heat conduction with the mounting base with which temperature control of the processed material put on the mounting base was carried out. Here, there are heating control and cooling control in the temperature control of a processed material.

[0007] The electrostatic chuck device for adsorbing and fixing a processed material to a mounting base is formed, by impressing direct current voltage to this electrostatic chuck device, electrostatic adsorption is carried out by electrostatic force and a processed material is fixed to a mounting base. The rear face of a processed material and the surface of a mounting base stick over the whole surface by this, and the homogeneity within a field of heat transfer and efficiency improve. The gas for heat transfers is introduced into the rear face of the processed material adsorbed and fixed to the mounting base, the heat transfer efficiency between a processed material and a mounting base is further raised by this gas, and it enables it to control the temperature of a processed material by this appropriately.

[0008] Generally there

are a device of the acyclic type provided with either one of the positive electrode or the negative terminal, a device of the bipolar type provided with a positive electrode and 1 set of negative terminal,

and a multi-electrode type device provided with 2 or more sets of positive electrodes and negative terminals in an electrostatic chuck device.

[0009]Next, a CDE device is explained with reference to drawing 2 as an example of the conventional vacuum processor. In drawing 2, the numerals 1 show the vacuum housing of a CDE device, the processing chamber (etching chamber) 2 is formed in the inside of this vacuum housing 1, and the water cooled jacket 3 for controlling the temperature of the processed material W which is a silicon wafer is being airtightly fixed to the pars basilaris ossis occipitalis of the vacuum housing 1.

[0010]The mounting base 4 made from the aluminum metals for laying the processed material W (wafer table) is formed in the upper part of the water cooled jacket 3.

The electrostatic chuck device 5 is built into this mounting base 4.

The medium passage 6 which constitutes a part of temperature control mechanism is formed in the inside of the water cooled jacket 3, and through the medium piping 7 and 8, the media M, such as cooling water by which the temperature control was carried out, are introduced into the inside of the medium passage 6, and are discharged.

[0011]Frame shape and the annular mounting base stop ring 45 are formed in the peripheral part of the mounting base 4, and this mounting base stop ring 45 is fixed to the upper surface of the water cooled jacket 3 by the mounting bolt 46, as shown in drawing 3. Therefore, the mounting base 4 is fixed to the water cooled jacket 3 via the mounting base stop ring 45.

[0012]As shown in drawing 2, as the top plate 9 of the vacuum housing 1 is penetrated, the active species introducing pipe 10 is attached, and the tip part of this active species introducing pipe 10 is connected to the gas distribution plate 11 formed in the processing chamber 2. This gas distribution plate 11 forms the shower-like nozzle, and the process gas G introduced into the inside of the processing chamber 2 via the active species introducing pipe 10 is uniformly supplied by the nozzle of the shape of this shower over the whole surface of the processed material W.

[0013]The quartz tube 12 is formed in the middle of the active species introducing pipe 10, and as this quartz tube 12 is surrounded, the plasma generator 13 is formed. And microwave is impressed from the plasma generator 13 to the process gas G supplied to the inside of the quartz tube 12. Then, glow discharge arises inside the quartz tube 12, plasma is generated, the process gas G is activated and active species is generated. Here, as the process gas G, the mixed gas containing for example, CF₄ and O₂ can be used.

[0014]Process gas including active species is introduced in the processing chamber 2 through the active species introducing pipe 10, and is uniformly supplied to the whole surface of the processed material W via the gas distribution plate 11. Then, the thin film of the surface of the processed material W is etched with the neutral active species (radical) in process gas. Here, evacuation of the processing chamber 2 is carried out by the vacuum pump (not shown) via the exhaust pipe 14, and the pressure inside the processing chamber 2 is measured by the pressure gauge 15.

[0015]The CDE device is

provided with the coolant gas feed mechanism 19 for supplying coolant gas to the rear-face side of the processed material W as shown in drawing 2.

This coolant gas feed mechanism 19 has the coolant gas introducing pipe 20 which penetrates the mounting base 4 and the chuck body 16, and is carrying out the opening under the processed material W.

In the middle of this coolant gas introducing pipe 20, the pressure gauge 21 and the gas mass flow control valve 22 are formed.

[0016]The discharge piping 23 has branched from the middle of the coolant gas introducing pipe 20 of the downstream rather than the gas mass flow control valve 22, and the variable valve 24 is formed while being this discharge piping 23. And the measurement value of the pressure gauge 21 is fed back, and the opening of the gas mass flow control valve 22 is adjusted automatically, and is usually maintained by the pressure of around 1000 Pa.

[0017]Drawing 3

is drawing of longitudinal section expanding and showing some of mounting bases 4 and electrostatic chuck devices 5. As shown in drawing 3, the electrostatic chuck device 5 is provided with the chuck body 16, and the chuck body 16 is constituted by multilayer structure by two or more filmy members.

[0018]That is, the chuck body 16 is provided with the conductive film 25 formed with the metal thin film. This conductive film 25 functions as an electrode plate with which voltage is impressed.

The insulating films 27a and 27b formed in both sides of the conductive film 25 with macromolecular

organic materials, such as a polyimide resin film, are arranged.

The whole surface of the conductive film 25 is covered with the insulating films 27a and 27b of these couples.

The insulating films 27a and 27b and the conductive film 25 are pasted up with the insulating high polymer adhesives 26a.

[0019]The lower insulating film 27b is pasted up on the surface 4a of the mounting base 4 with the insulating high polymer adhesives 26b. The protective film 28 which consists of fluororesin, such as a poly ethylene tetrafluoride (PTFE) film, has pasted the surface of the upper insulating film 27a, i.e., the field in which the processed material W is laid, using the high polymer adhesives 26c, The insulating films 27a and 27b which consist of macromolecular organic materials, such as a polyimide resin film, are protected.

[0020]Drawing 4

is shown and other examples of the electrostatic chuck device 5 The insulating film 27a of the chuck body 16, 27b is formed of the charge of a ceramic material, and the insulating films 27a and 27b made from these ceramics and the metal conductive films 25 are directly joined by sintering, without using adhesives. In this case, it is not necessary to form the protective film 28 for protection in the surface of the upper insulating film 27a. The undersurface of the lower insulating film 27b made from ceramics is pasted up on the surface 4a of the mounting base 4 with high polymer adhesives or the low melting point metal 26.

[0021]DC power supply 43 shown in drawing 2 are connected to the conductive film 25, and voltage is impressed to the conductive film 25 by these DC power supply 43. And when voltage is impressed to the conductive film 25, the processed material W is adsorbed to the mounting base 4 and fixed by electrostatic force.

By forming the ammeter 44 between the conductive film 25 and DC power supply 43, it is possible to observe the current which flows into the conductive film 25, and the existence of the processed material W can be detected by this.

[0022]In the conventional electrostatic chuck device mentioned above, high polymer adhesives, such as an epoxy system, acrylic, and a silicone series, are used as insulating adhesives for pasting up the chuck body 16 on the surface 4a of the mounting base 4.

[0023]When the insulating films 27a and 27b are the products made from ceramics, the chuck body 16 may be fixed to the surface 4a of the mounting base 4 with a low melting point metal besides said high polymer adhesives, but metal with the low melting points, such as solder of a tin lead alloy and indium, is used for the low melting point metal in this case.

[0024]However, as shown in drawing 3, some high polymer adhesives 26c 47 between the protective film 28 and the surface 4a of the mounting base 4 are exposed to the building envelope of the processing chamber (etching chamber) 2 in the periphery position of the mounting base 4. As shown in drawing 4, the high polymer adhesives between the insulating film 27b made from ceramics and the surface 4a of the mounting base 4 or some low melting point metals 26 47 are exposed to the building envelope of the processing chamber (etching chamber) 2 in the periphery position of the mounting base 4.

[0025]For this reason, the exposed part 47 of high polymer adhesives or a low melting point metal, The reactive gas at the time of carrying out vacuum treating of the processed material W (corrosion gas, deposition gas, etc.) corrodes in the inside of a short time, and there is a possibility that peeling from generating of dust (particle), metallic contamination, and the mounting base surface 4a of the chuck body 16, etc. may be caused.

[0026]Drawing 5

(a) and (b) shows an example of the electrostatic chuck device provided with the means for preventing the corrosion of the exposed part 47 of high polymer adhesives or a low melting point metal. Drawing 5 (b) is drawing of longitudinal section expanding and showing the B section of (a).

[0027]As shown in drawing 5

(a) and (b), this electrostatic chuck device is provided with the fluoro-resin ring 61 welded by pressure to the mounting base 4 and the chuck body 16, and the ferrule 62 for fixing this fluoro-resin ring 61.

[0028]The fluoro-resin ring 61 is ** constituted with the connecting part 65 of the shape of a section abbreviation C character which connects the 1st annular pressure welding face 63 welded by pressure to the protective film 28 of the surface of the chuck body 16, the 2nd annular pressure welding face 64 welded by pressure to the side periphery side 4c of the mounting base 4, and the 1st pressure welding

face 63 and the 2nd pressure welding face 64. Here, the fluoro-resin ring 61 is formed by 4 resin fluoridation, and is preferably formed of poly ethylene tetrafluoride (PTFE).

[0029]The ferrule 62 is contacted by the upper surface of the connecting part 65 of the fluoro-resin ring 61, and it is being fixed to the upper surface of the mounting base stop ring 50 by the mounting bolt 68. Here, the ferrule 62 coats fluororesin on the surface of a metallic member, and is formed. The mounting base stop ring 50 is fixed to the upper surface of the water cooled jacket 3 by the mounting bolt 51.

[0030]As for the fluoro-resin ring 61 pressed by the ferrule 62, the operation of power received from the tapered surface 53 of the mounting base stop ring 50 also isolates airtightly the exposed part 47 of high polymer adhesives or a low melting point metal from the building envelope of the processing chamber 2 conjointly. The surroundings lump to the exposed part 47 of the process gas which includes active species as come is prevented.

[0031]

[Problem(s) to be Solved by the Invention]However, in the conventional electrostatic chuck device shown in drawing 5, Since the ferrule 62 and the mounting base stop ring 50 are formed with the metallic material, For example, when etching/ashing was performed under rich conditions O₂, there was a problem that the homogeneity of processing of the processed material W deteriorated under the influence of the metallic material which constitutes ferrule 62 grade.

[0032]Then, an object of this invention is to provide the mounting base provided with the electrostatic chuck device which the corrosion of the exposed part of the high polymer adhesives used for immobilization of a chuck body or a low melting point metal can be prevented, and can maintain the homogeneity of processing good, and this device.

[0033]

[Means for Solving the Problem]In an electrostatic chuck device formed in a mounting base inside a processing chamber in order that this invention may carry out adsorption maintenance of the processed material according to electrostatic force, A conductive film in which voltage is impressed when adsorbing said processed material, and an insulating film of a couple which puts this conductive film from both sides, Have a chuck body which **** and said chuck body is stuck on the surface of said mounting base with adhesives or a low melting point metal, An exposed part of said adhesives exposed in a periphery position of said chuck body or a low melting point metal, Of a protect ring member formed with fluororesin, it is airtightly isolated from a building envelope of said processing chamber, a bolthole is formed in said protect ring member, and said protect ring member is fixed to an inside of said processing chamber by a mounting bolt inserted in said bolthole.

[0034]The 1st circumferentia to which said protect ring member counters an edge part of the surface of said chuck body, Have the 2nd circumferentia that counters a base part of said mounting base, and the 1st O ring and 2nd O ring are provided in said 1st circumferentia and said 2nd circumferentia, respectively, It is desirable to isolate airtightly said exposed part of said adhesives or a low melting point metal from a building envelope of said processing chamber according to inner skin of said 1st and 2nd O rings and said protect ring member.

[0035]As for said mounting bolt, it is desirable that it is a shoulder bolt which can prevent breakage of said protect ring member by excessive bolting.

[0036]Said mounting base can be fixed to an inside of said processing chamber by fixing said protect ring member to an inside of said processing chamber with said mounting bolt.

[0037]Said chuck body may be provided with a protective film which comprises fluororesin stuck on the surface.

[0038]A mounting base of a processed material by this invention is characterized by a thing for which it shifted, and has that electrostatic chuck device, and said chuck body is stuck on the surface with said adhesives or a low melting point metal to mention above.

[0039]

[Embodiment of the Invention]Hereafter, the mounting base provided with the electrostatic chuck device by one embodiment and this device of this invention is explained with reference to drawing 1 (a) and (b). The electrostatic chuck device and mounting base by this embodiment are incorporable into the chemical-dry-etching device (CDE device) of the downflow type shown, for example in drawing 2. The electrostatic chuck device and mounting base by this embodiment are incorporable into various vacuum processors as stated above besides a CDE device.

[0040]Drawing 1

(a) is drawing of longitudinal section showing the outline composition of the electrostatic chuck device by this embodiment, and a mounting base, and drawing 1 (b) is drawing of longitudinal section expanding and showing the A section of (a).

[0041]As shown in drawing 1

(a) and (b), the electrostatic chuck device by this embodiment is provided with the following.

The conductive film 25 (refer to drawing 3 and drawing 4) in which voltage is impressed when it has the chuck body 16, this chuck body 16 comprises the same composition as the chuck body 16 in the conventional electrostatic chuck device shown in drawing 3 or drawing 4 and the wafer (processed material) W is adsorbed.

The insulating films 27a and 27b of the couple which puts this conductive film 25 from both sides.

[0042]The chuck body 16 is stuck on the surface of the mounting base 4 with high polymer adhesives or a low melting point metal, and high polymer adhesives or a low melting point metal is exposed in the periphery position of the chuck body 16. The exposed part 47 of these high polymer adhesives or a low melting point metal is airtightly isolated from the building envelope of the processing chamber 2 by the protect ring member 70. Here, as for the protect ring member 70, the whole is formed with fluororesin, such as 4 resin fluoridation.

[0043]The bolthole 71 penetrates to the protect ring member 70 up and down, and is formed in it, and the protect ring member 70 is being fixed to the water cooled jacket 3 by the mounting bolt 72 inserted in this bolthole 71. In order to prevent the modification by past [at the time of bolting immobilization of the protect ring member 70 which comprises fluororesin] a bundle, the shoulder bolt is used for the mounting bolt 72. The head of the mounting bolt 72 which comprises this shoulder bolt is buried in the inside of the bolthole 71.

[0044]The protect ring member 70 is provided with the following.

The 1st circumferentia 73 that is provided with inverse L-shaped sectional shape, and counters the edge part of the protective film 28 of the surface of the chuck body 16.

The 2nd circumferentia 74 that counters the upper surface of the base part 4b of the mounting base 4.

[0045]The 1st O ring groove 75 and 2nd O ring groove 76 are engraved on the 1st circumferentia 73 and 2nd circumferentia 74, respectively, and the 1st O ring 77 and 2nd O ring 78 are put on these slots 75 and 76, respectively.

[0046]And 1st O ring 77 is welded by pressure to the edge part of the protective film 28 of the surface of the chuck body 16 by fastening the mounting bolt 72, and 2nd O ring 78 is welded by pressure to the upper surface of the base part 4b of the mounting base 4. As a result, the exposed part 47 of high polymer adhesives or a low melting point metal is airtightly isolated by the inner skin 79 of 1st and 2nd O rings 77 and 78 and the protect ring member 70 from the building envelope of the processing chamber 2.

[0047]By fixing the protect ring member 70 to the water cooled jacket 3 with the mounting bolt 72, the mounting base 4 is caudad pressed by the 1st and 2nd circumferentia 73 and 74, and the mounting base 4 is fixed to the upper surface of the water cooled jacket 3 by this.

[0048]The thing of the structure shown in drawing 4 may be sufficient as the chuck body 16 of the electrostatic chuck device by this embodiment, or the thing of other structures may be sufficient as it also at the thing of the structure shown in drawing 3. In short, the structure of chuck body 16 the very thing is unquestioned, the chuck body 16 has pasted the mounting base 4 with high polymer adhesives or a low melting point metal, and when high polymer adhesives or a low melting point metal is moreover exposed in the periphery position of the chuck body 16, it can apply this embodiment.

[0049]As stated above, according to the electrostatic chuck device and mounting base by this embodiment. The exposed part 47 of the high polymer adhesives exposed in the periphery position of the chuck body 16, or a low melting point metal, Since it is airtightly isolable from the building envelope of the processing chamber 2 by the protect ring member 70 which has 1st and 2nd O rings 77 and 78, During processing of the processed material W, the exposed part 47 does not contact process gas (reactive gas), even when prolonged processing is performed, the exposed part 47 does not corrode with process gas, and This sake, Generating of dust (particle), metallic contamination, peeling from the surface 4a of the mounting base 4 of the chuck body 16, etc. can be prevented.

[0050]Since according to this embodiment the whole is formed with fluororesin as for the protect ring member 70 and the metallic member is not arranged around the wafer W, in a rich etching process, the

homogeneity of processing does not deteriorate under the influence of a metallic member O₂, for example.

[0051] Since the exposed part 47 of high polymer adhesives or a low melting point metal was isolated using 1st and 2nd O rings 77 and 78, airtightness increases and the protective effect of the exposed part 47 can be heightened.

[0052]

[Effect of the Invention] Since the exposed part of the high polymer adhesives exposed in the periphery position of a chuck body or a low melting point metal is airtightly isolable from the building envelope of a processing chamber by a protect ring member according to this invention as stated above, During processing of a processed material, an exposed part does not contact process gas, even when prolonged processing is performed, an exposed part does not corrode with process gas, and This sake, Since peeling from generating of dust (particle), metallic contamination, and the mounting base surface of a chuck body, etc. can be prevented and the protect ring member is formed with fluororesin, degradation of the homogeneity of processing by existence of a metallic material can be prevented.

[Translation done.]